ARJUNA

JEE

LECTURE - 03

Mole Concept

Sarvesh sir

TABLE OF CONTENT

01 Mole in term of mass

02

03

04

Q. The number of He atoms in 100 mole of a He gas is ($N_A = 6.023 \times 10^{23}\ mol^{-1}$)

A. 6.026×10^{22}

B. 600×10^{24}

C. 6.022×10^{25}

D. 1.800×10^{22}

20 Sec

$$\text{No. of mole} = \frac{\text{given Number}}{6.022 \times 10^{23}}$$

$$\text{Number of He} = \text{No. of mole} \times 6.022 \times 10^{23}$$

$$= 100 \times 6.022 \times 10^{23}$$

$$= 6.022 \times 10^{25}$$

ARJUNA

Mole in term of mass of substance

$$\text{No. of mole} = \frac{\text{given weight in gram}}{\text{Molecular weight}} = \frac{W}{M.wt}$$

M.wt = sum of atomic wt

$= 2\times1 + 16\times1$

$= 2 + 16 = \underline{18}$

Q → 1.8 gram H_2O present in container.

Calculate No. of mole of H_2O

Sol^n → No. of mole of $H_2O = \frac{\text{wt. of } H_2O}{\text{M.wt of } H_2O}$

$= \frac{1.8}{18} = 0.1 \text{ mole}$

$C_{SD}=5$

① No. of mole $= \dfrac{\text{wt. in gram}}{\text{M.wt}} = \dfrac{\text{mass of substance in gram}}{\text{M.wt}}$

② wt. of substance = No. of mole $\times$ M.wt

(3) $\dfrac{\text{No. of molecule}}{6.022\times10^{23}} = \dfrac{\text{wt.}}{\text{M.wt}}$

$\rightarrow$ Number of molecules $= \dfrac{\text{wt}}{\text{M.wt}} \times 6.022\times10^{23}$

$\rightarrow$ Mass $\xrightarrow[\div \text{ M.wt}]{}$ Mole $\xrightarrow[\times 6.022\times10^{23}]{}$ Number

ARJUNA

Q 0.98 gram H_2SO_4

Calculate (M.wt of H_2SO_4 = 98)

(a) No. of mole of H_2SO_4

(b) No. of molecules of H_2SO_4

(M-2) No. of molecules = mole × N_A

$= 10^{-2} \times 6.027 \times 10^{23}$

$= 6.022 \times 10^{21}$

Sol^n (a) No. of mole of H_2SO_4 = $\frac{Wt}{M.wt}$

$= \frac{0.98}{98} = 10^{-2}$ mole

(b) No. of molecules of H_2SO_4

$= \frac{wt}{M.wt} \times 6.022 \times 10^{23}$

$= \frac{0.98}{98} \times 6.022 \times 10^{23}$

$= 10^{-2} \times 6.022 \times 10^{23}$

$= 6.022 \times 10^{21}$

Q 0.0585 gram NaCl present in Container. (Mwt of NaCl = 58.5)

(1) No. of mole of NaCl is

(a) 10^{-1} (b) 10^{-2} (c) 10^{-3} (d) 10^{-4}

(2) No. of molecules of NaCl in Container is

(a) $10^{-1}N_A$ (b) $10^{-2}N_A$ (c) $10^{-3}N_A$ (d) $10^{-4}N_A$

Soln ⇒ (a) Mole of NaCl = $\frac{0.0585}{58.5} = 10^{-3}$

(b) No. of molecules = No. of mole × N_A

$= 10^{-3} \times N_A = 10^{-3}N_A$

ARJUNA

(3) Calculate total No. of ions in Containers

(a) $10^{-2} N_A$ (b) $2\times10^{-3} N_A$ (c) $2\times10^{-4} N_A$ (d) $4\times10^{-4} N_A$

$Na_x U_y$

total No. of ions $= (1+1)\times10^{-3}\times N_A = 2\times10^{-3} N_A$

total No. of ions $= (x+y) \times$ Mole of Nall $\times N_A$

$= (1+1)\times10^{-3}\times N_A$

$C_{SD} = 6$

Suppose → $A_xB_y \longrightarrow xA^{+y} + yB^{-x}$

No. of total A-atom = $x \times$ No. of mole of $A_xB_y \times N_A$

No. of total B-atom = $y \times$ No. of mole of $A_xB_y \times N_A$

No. of total atoms = $(x+y) \times$ No. of mole of $A_xB_y \times N_A$

Q. How many atoms are contained in one mole of sucrose ($C_{12}H_{22}O_{11}$)?

A. $45 \times 6.02 \times 10^{23}$

B. $0.45 \times 6.02 \times 10^{23}$

C. $4.50 \times 6.02 \times 10^{23}$

D. None of the above

20sec

No. of total atoms = (12+22+11) × No. of mole sucrose × N_A

$= 45 \times 1 \times 6.022 \times 10^{23}$

Q. 0.01 mole of O_3 gas present in container , the total number of atoms in container is

A 0.3×10^{24}

B 6.022×10^{22}

C 6.022×10^{21}

D None of these

Ans batao → 20sec.

1 Rs ⇒ papa se le lena

No. of O-atom = $3 \times 0.01 \times 6.022 \times 10^{23}$

$= 18.066 \times 10^{21}$

$= 1.8 \times 10^{22}$

ARJUNA

Q.

Which of the following samples contains the highest number of atoms?

$Cu = 63.5$

A: 1 gram of Cu(s) $= \frac{1}{63.5} \times N_A$

B: 1 gram of O_2(g) $\rightarrow 2 \times \left(\frac{1}{32}\right) \times N_A$

C: 1 gram of C(s) $\rightarrow \left(\frac{1}{12}\right) \times N_A$

D: 1 gram of Be(s) $\rightarrow \left(\frac{1}{9}\right) \times N_A$

Ans batao ⇒ 60 sec

Sol^n → Mass $\xrightarrow{\div \text{M·wt}}$ Mole $\xrightarrow{\times N_A}$ Number

ARJUNA

Q. Aspirin has the formula $C_9H_8O_4$. How many atoms of oxygen are there in a tablet weighing 360 mg?

360×10^{-3} gram

A	1.204×10^{23}	C	1.08×10^{22}
B	1.204×10^{24}	D	4.81×10^{21}

C → $9 \times 12 = 108$
H → $1 \times 8 = 8$
O → $4 \times 16 = 64$
M·wt = 180

Soln → No. of O-atom = $4 \times$ No. of mole $\times N_A$

$$= 4 \times \left(\frac{360 \times 10^{-3}}{180}\right) \times 6.022 \times 10^{23}$$

$$= 4 \times 2 \times 6.022 \times 10^{23} \times 10^{-3}$$

$$= 4.81 \times 10^{21}$$

ARJUNA

$C_{SD} = 7$

$A_xB_y \rightarrow$ neutral molecule

① No. of total electrons (e^-) $= \left(\sum Z_i X_i\right) \times$ No. of mole of $A_xB_y \times N_A$

where → Z = Atomic Number of atoms

$X \rightarrow$ suffix of atoms (↑ Jo nichhe liKha hota hai → x, y etc. Atom)

total No. of electrons $= \left(Z_A X_A + Z_B X_B - - - -\right) \times$ No. of mole of $A_xB_y \times N_A$

② total No. of proton(s) in A_xB_y molecules $= \sum Z_i X_i \times$ No. of mole of $A_xB_y \times N_A$

$C_{SD} = 8$

A_x^{n+} or A_x^{n-} → ions

→ total No. of electrons in A_x^{+n} (Cation) $= \left(\sum z_i x_i - n \right) \times$ No. of mole of $A_x^{+n} \times N_A$

→ total No. of electrons in A_x^{-n} (Anion) $= \left(\sum z_i x_i + n \right) \times$ No. of mole of $A_x^{-n} \times N_A$

Q → Calculate total No. of e^- in 1 mole of SO_4^{-2} ions.

Sol^n ⇒ No. of total $e^- = \left[16 \times 1 + 8 \times 4 + 2 \right] \times 1 \times N_A$

$= 50 \times 1 \times N_A$

Cation → +ve charge on the ion → Ca^{+2}, Mg^{+2}, Na^{+}, NH_4^{+} etc

$$Na(s) \longrightarrow Na^{+}(g) + e^{-}$$

→ lose of e^{-}

$$Mg(g) \longrightarrow Mg^{+2} + 2e^{-}$$

Anion → -ve charge on the ion → SO_4^{-2}, Cl^{-}, O^{-2}, PO_4^{-3}, $Cr_2O_7^{-2}$

$$Cl + e^{-} \longrightarrow Cl^{-}$$
$$O + 2e \rightarrow O^{-2}$$

} → gain of e^{-}

Q. Calculate total No. of e^- in 1.8 gram H_2O liquid. (At No. → H=1, → O=8)

Soln → 1.8 gram H_2O

total No. of electrons = $\left(\sum Z_i x_i\right) \times$ No. of mole of $H_2O \times N_A$

$= \left(1\times2 + 8\times1\right) \times \left(\frac{1.8}{18}\right) \times N_A$

$= 10 \times \frac{1.8}{18} \times N_A$

$= \underline{\underline{N_A}}$

Q. The total number of electrons in 10 gram of calcium carbonate ($CaCO_3$) is
(NA=6.023×10^{23})

$CaCO_3$

Ca = 20
C = 6
O = 8

A 1.5057×10^{24}

C 2.0478×10^{24}

B 3.0115×10^{24}

D 4.0956×10^{24}

Soln → total No. of electrons = $\left(20\times1 + 6\times1 + 8\times3\right) \times \left(\frac{10}{100}\right) \times 6.022\times10^{23}$

$= 50 \times 10^{-1} \times 6.022 \times 10^{23}$

3.0110×10^{24}

ARJUNA

Q. Total number of electrons present in 48gram Mg^{2+} ion are :

Mg-12

ions

A 24 *NA*

B 20 *NA*

C 2 *NA*

D None of these

total No. of electrons $= \left(\sum z_i x_i - n\right) \times$ No. of mole of $Mg^{+2} \times N_A$

$= \left(12 \times 1 - 2\right) \times \left(\frac{48}{24}\right) \times N_A$

$= 20 N_A$

ARJUNA

$C_{SD} = 9$

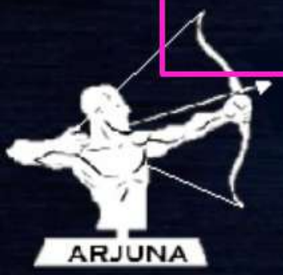
$A_x^{+\eta}$ or $A_x^{-\eta}$ → Cation or Anion

total charge present in ions = η × No. of mole of ions × $N_A \times 1.6 \times 10^{-19}$ Coulomb

Q → Calculate total charge in coulomb present in 0.32 gram Sulphide (S^{-2}) ions.

Sol^{n} → total charge = $2 \times \left(\frac{0.32}{32}\right) \times N_A \times 1.6 \times 10^{-19}$

$= 2 \times 10^{-2} \times N_A \times 1.6 \times 10^{-19}$ C



Q. Find the charge in coulomb of 27 gm of Al^{3+} ions.

Al^{+3}

$Al = 27$

A $1.6 \times Na$

B 4.8×10^{-19}

C $4.8 \times 10^{-19} \times Na$

D $4.8 \times Na$

total charge in Al^{+3} = $n \times$ No. of mole of ions $\times N_A \times 1.6 \times 10^{-19} C$

$= 3 \times \left(\frac{27}{27}\right) \times N_A \times 1.6 \times 10^{-19} C$

$= 4.8 \times N_A \times 10^{-19} C$

ARJUNA

$C_{SD}=10$ $A_xB_y \rightarrow$ neutral

① total No. of protons $(p^+) = \left(\sum z_i x_i\right) \times$ No. of mole of $A_xB_y \times N_A$

② $A_x^{+n} \rightarrow$ Cation
$A_x^{-n} \Rightarrow$ Anion
$\Big\} \rightarrow$ total No. of proton $(p^+) = \left(\sum z_i x_i\right) \times$ No. of mole of ions $\times N_A$

③ total No. of Neutron(s) $= \left[\sum (A-Z)_i X_i\right] \times$ No. of mole of molecules $\times N_A$

→ Neutral molecules
→ Cation
→ Anion
$\Big\} \rightarrow$ same formula.

Q ⇒ Calculate total No. of neutron in 0.01 mole H_2O.

$_1H$: $1 = A$, $A - Z = 1 - 1 = 0$, $1 = Z$

$_8O$: $16 = A$, $8 = Z$, $= 16 - 8 = 8$

Sol^n No. of neutron (n^o) $= (0 \times 2 + 8 \times 1) \times 0.01 \times N_A$

$= 8 \times 0.01 \times N_A$

$= 0.08 N_A$

Atom representation → $_{Z}X^{A}$ or $^{A}_{Z}X$ or X^{A}_{Z}

Where → Z = Atomic Number

A = Mass number ($A = p + n$)

$A = p + n$

$n = A - p$

$n = (A - Z)$ (Atomic No. (Z) = total No. of proton present in atom)

$(Z = p)$

ARJUNA

Home work

Dpp-01

Dpp-02

Thank - You